

A REVIEW OF THE GENUS *CRICOTOPUS* IN OHIO, WITH A KEY TO ADULTS OF SPECIES OF THE NORTHEASTERN UNITED STATES (DIPTERA, CHIRONOMIDAE)¹

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ABSTRACT. In the northeastern states, 21 species of *Cricotopus* are recognized: *C. sylvestris*, uncommon in Ohio but abundant in California, the larvae feeding on rice plants, *Spirogyra*, *Myriophyllum* and other vegetation; *C. trifasciatus* (= *remus*), with larvae mining in and skeletonizing leaves of *Potamogeton*, *Polygonum*, *Nuphar*, *Nymphaea* and *Nelumbo*; *C. bicinctus*, living as larvae in masses of *Spirogyra*, capable of withstanding low oxygen levels and showing remarkable resistance to pollution by industrial wastes; *C. tricinatus* (= *lebetis*), more or less questionably distinct from *C. trifasciatus*; *C. triannulatus* (= *exilis*), a northern Holarctic species associated with swift streams or shallow areas of lakes subject to wave action; *C. politus*, a clean-water species of lakes and streams; *C. varipes* and *C. slossonae*, closely related species showing a positive response to crude oil contamination; *C. absurdus*, with Neotropical affinities and apparently rare in the northern Nearctic; *C. fugax*, not recorded since it was described; *C. flavibasis*, closely related to *C. sylvestris*; *C. infuscatus* (= *aratus*, *ceris*), with larvae showing considerable resistance to heavy-metal pollution; *C. vierriensis*, easily confused with *C. bicinctus*, with larvae able to withstand high salt concentrations; *C. trifascia* (= *ithacanensis*), having larvae present in small numbers in streams; *C. flavipes*, relatively rare, the larvae making linear mines in submerged leaves of *Potamogeton*; *C. elegans*, rarely reported, with larvae riddling the floating leaves of *Potamogeton*; *C. junus*, with larvae inhabiting hard-bottom creeks; and *C. nostocicola*, with larvae feeding on *Nostoc* and attaching the algal colonies to rocks and other objects. New species are *C. diversus*, with ♀ similar to *C. junus* except for leg coloration and to the European *C. festivellus* except for details of abdominal coloration; *C. baptistenis*, known only from southern Canada but at the latitude of Michigan; and *C. olivetus*, probably most closely related to *C. fugax* and the European *C. annulator*.

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INTRODUCTION

The genus *Cricotopus* is of particular importance in stream ecology. In a recent study of a small limestone stream subjected to heavy-metal pollution, the relative abundance of the genus proved to be ecologically significant. In the area of heaviest pollution, *Cricotopus* larvae made up about 90% of the chironomid population; at about 3.4 km downstream they constituted only about 20% of that population (Winner et al 1980). Furthermore, species within the genus exhibit a wide range of environmental demands. The

present paper is an attempt to summarize information available for species of northeastern United States and to provide a key facilitating determination of adults. So far as possible both dry and slide-mounted individuals have been studied. Dry specimens reveal traits such as wing reflections and surface texture but slide-mounted material is highly desirable for microscopic details. Quite certainly specimens will be found which will not fit into any key, for aberrant individuals are not uncommon.

No current study of *Cricotopus* can ignore the monumental work of Hirvenoja (1973). He noted that color variation occurs widely in *Cricotopus*. In some species he recognized and figured normal, dark and light forms

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where in fact all gradations of color occur. He also noted considerable variation in size. Color in some chironomids is known to vary with degree of maturity (Boesel 1974). As indicated by Johannsen (1905), in making determinations in *Cricotopus* it is extremely important to note that in melanistic specimens areas of the abdomen that are normally yellow-white tend to be black. However when such specimens are examined at an appropriate angle, surfaces which are typically or commonly yellow-white are shining whereas those that are black are velvety or dull. Numerical characteristics must be viewed with caution. Figures cited in this paper were arrived at by constant revision as new specimens became available. Although a single most representative figure may be given, deviation from that figure is the rule. Commonly a deviation of 10 to 15% or even more may be expected in the case of leg ratio; antennal ratio varies even more. The latter is probably best determined on slide-mounted material that has never been allowed to dry. Bristle counts on various parts of the body tend to be highly variable and are useful only where marked differences occur.

Several species have been deliberately excluded from the discussion and keys. The occurrence of *C. tremulus* in the Nearctic region is questionable. Early Nearctic records should probably be referred to *C. slossonae*. It is possible *C. slossonae* is a Nearctic form of *C. tremulus*. A second species, *C. oceanicus*, was inadequately described by Packard in 1869, probably from teneral material, and has not been recognized since that time. A third species, *C. geminatus*, described by Say in 1823, lacks the support of any solid records.

Early workers limited the genus *Cricotopus* to species with bicolored legs, hairy eyes and small or no pulvilli. Following Edwards (1929), later workers placed greater emphasis on the scutal hairs. Species with minute, decumbent hairs were included in *Cricotopus* even though they lacked the whitish markings usually associ-

ated with the genus. Species with strong, erect hairs with distinct bristle punctures were placed in *Trichocladius*, which was commonly regarded as a subgenus of *Orthocladius* or *Spaniotoma* or given generic rank. The present paper adopts a broad concept for *Cricotopus* but excludes the species which have traditionally been assigned to *Trichocladius* and sometimes referred to *Rheocricotopus*, *Acricotopus* or *Paratrichocladius*. Included, however, are species sometimes listed under *Isocladius* and *Halocladius*. Hirvenoja (1973) treated all of these as relatives ("Verwandten") of *Cricotopus*. To what extent some of these names should be retained as genera or even as subgenera is an open question.

METHODS AND MATERIALS

Specimens used for the current study were collected principally in Ohio over a period of more than 50 years. Nearly all parts of the state are represented but particular attention has been accorded the island area of western Lake Erie, which is particularly rich in midges. Naturally many specimens have been taken in the vicinity of Columbus and Oxford. Fortunately I have had the opportunity of collecting rather extensively also in New York (Ithaca area) and Michigan (Douglas Lake area). The majority of specimens, about 1350, are on points; about 500 are in the form of permanent mounts in diaphane on slides. Many of the latter have been reared so that larval and pupal exuviae are available, mounted on the same slide with the adult. All specimens have been examined critically.

KEYS TO ADULTS

Systematists quite naturally have given more attention to males than to females. In numerous instances the latter have been described rather casually and briefly in terms of the male. Evidence currently available suggests that it is hazardous to assume any particular degree of difference between the sexes. Unfortunately in a number of instances only one sex is known. Males and females are therefore keyed separately. If a sex is unknown it is omitted from the keys. In the couplets, characteristics enclosed in brackets should be useful but are not necessarily contrasting. The keys have been constructed to accommodate both dry and slide-mounted specimens by the use of multiple characteristics. For a variety of

reasons certain names are excluded from the keys. Such exclusions have been discussed in the introduction.

Abbreviations adopted for use in the keys and descriptions follow. All have appeared previously in the literature. In *Cricotopus*, wing veins clearly expressed and reaching the wing margin are presumed to be R_1 , R_{2+3} , R_{4+5} , M, Cu_1 and Cu_2 . Subcosta and the anal veins are relatively weak. Costa forms the anterior wing margin and may or may not extend beyond the tip of R_{4+5} .

L: total length, excluding antennae. WL: length of wing, from arculus to tip. WW: maximum width of wing. AR: antennal ratio; terminal flagellomere/remaining flagellomeres. th: thorax, thoracic. abd: abdomen, abdominal, abdominal segment. w, ww: wing, wings. fCu: cubital fork. f, ff; lf, 2f, 3f: femur, femora; fore femur, mid femur, hind femur. t, tt; lt, 2t, 3t: tibia, tibiae; fore tibia, mid tibia, hind tibia. x, xx; lx, 2x, 3x: tarsus, tarsi; fore tarsus, mid tarsus, hind tarsus. x_1 , x_2 , x_3 , x_4 , x_5 : 1st, 2nd, 3rd, 4th, 5th tarsal segment. LR: leg ratio; lx_1/lt .

KEY TO MALES

1. Legs uniformly clear yellow, including ff; [ww milky, veins glassy clear; LR 0.55; abd segments largely dark above, light below, sometimes darker posteriorly and appearing black-banded; R_{2+3} slightly curved, ending halfway between R_1 and R_{4+5} ; pronotum posteriorly depressed and set off from scutum] *C. flavipes*
1. Legs variously darkened, infusate yellow or distinctly bicolored (2)
2. tt not partly white but sometimes infusate or darker at ends; abd except for genitalia never with distinct yellow-white markings (3)
2. At least lt distinctly ringed yellow-white; abd usually partly yellow-white or shining light olive-green (8)
3. R_{2+3} weak, nearly straight; distance between tips of R_1 and R_{2+3} about 2 times distance between R_{2+3} and R_{4+5} ; [LR 0.51; ww brownish, veins slightly darkened (yellowish in slide mounts); abd segments largely dark above, light below, sometimes yellowish posteriorly and appearing yellow-banded; pronotum nearly in line with scutum; genitalia dark] *C. elegans*
3. R_{2+3} relatively strong, curving toward C; distance between tips of R_1 and R_{2+3} equal to or less than distance between tips of R_{2+3} and R_{4+5} ; LR 0.58–0.75 (4)
4. Genitalia yellow-white; [abd 1 and part of abd 2 greenish; rest of abd largely blackish, darker posteriorly] *C. fugax*
4. Genitalia dark (5)
5. Scutellar hairs sparse, largely confined to a single transverse row; scutal ground color typically pale (yellow, green, light brown); humeri pale; tarsal claws acute (fig. 1), not apically enlarged (6)
5. Scutellar hairs numerous, scattered; scutal ground color dark brown or black, including humeri; tarsal claws, at least of mid legs, apically enlarged, pectinate (fig. 2) (7)
6. Scutum typically with dark greenish ground color and black vittae; LR 0.59; AR 1.3; abd blackish; scutellum usually blackish; C only slightly produced *C. infuscatus*
6. Scutum typically with yellow ground color and contrasting black vittae; LR 0.70; AR 1.7; abd yellowish or olive brown; scutellum usually more or less yellowish; C distinctly produced *C. politus*
7. Halteres blackish; scutum more or less pruinose; basistyle with a single large basal lobe; scutellar bristles in a single transverse row; arculus black *C. nostocicola*
7. Halteres yellowish; scutum shining; basistyle with 2 small basal lobes (fig. 3); scutellar bristles scattered, not in a row; arculus yellow or brownish yellow *C. baptistensis*
8. abd 1 olive green; [anterior tergites behind abd 1 greenish or greenish with a brown saddle or band; posterior tergites velvety brown, incisures variable; scutum shining dark brown; lt largely whitish; lx brown; pronotum in lateral view narrow above, gradually widened to base; not flaring] *C. olivetus*
8. abd 1 yellow-white; at least one tergite behind abd 1 entirely or partially yellow-white (9)
9. abd 1 and 2 uniformly yellow-white or nearly so; [scutellar bristles fine, largely confined to a single transverse row; scutum, scutellum and postnotum black; incisures 3–4 and 4–5 yellowish or smooth; white band almost confined to basal half of lt] (10)
9. abd 2 not similar to abd 1 in coloration, with more than a dorsomedial black spot or suggestion of a brownish saddle or abd 4 and 5 more than half yellow-white (11)
10. lx uniformly dark brown; dististyle fusiform, distinctly expanded at middle; terminal peg of dististyle long, yellowish and apically sharp *C. varipes*
10. lx with x_2 or more pale; dististyle subcylindrical, only slightly broader at middle; terminal peg of dististyle short, brownish and apically dull *C. slossonae*
11. abd 4 and 5 similarly marked, with anterior half or more yellow-white, the division between colors being vertical; [lt largely yellow-white, narrowly black basally, broader apically but distinctly more than half pale; scutum yellow with 3 black vittae; scutellar bristles fine, hairlike, leaning medially] *C. triannulatus*

11. abd 4 and 5 dissimilar or scutellar bristles spinelike or lt with basal black band longer than apical black band.....(12)
12. Scutellar bristles spinelike, straight and stiff and/or lt with basal black band longer than apical black band.....(13)
12. Scutellar bristles fine, inconspicuous, curved and leaning medially and lt with apical black band normally distinctly stronger than basal black band.....(16)
13. lx with long hairs; [prescutellar area yellow; incisures 2-3 and 3-4 commonly more broadly yellow-white than more posterior incisures].....*C. flavibasis*.....(14)
13. lx with short hairs.....(14)
14. Prescutellar area black; scutum nearly all black; 2f and 3f light basally, grading into dark apically.....*C. tricinctus*.....(15)
14. Prescutellar area yellow; scutum yellow with blackish vittae; 2f and 3f largely yellow-white rather sharply separated from black apex.....(15)
15. abd 1 mainly and narrow margins of other tergites yellow-white; incisures 3-4 and 4-5 usually yellowish.....*C. sylvestris*.....(16)
15. abd 1, 4 and 7 typically yellow-white; abd 4 sometimes with a black spot and abd 7 partly or almost wholly black; abd 2 and 5 variably yellow-white anteriorly; incisures variable.....*C. trifasciatus*.....(17)
16. abd 4 with anterior third or fourth brown-black, the rest yellow-white; [scutum infuscate yellow to brownish with yellow humeri; LR 0.62; abd 1, a fourth of abd 2, incisures 2-3 and 3-4, posterior two-thirds or more of abd 4 and anterior fourth or more of abd 5 yellow-white; incisures 5-6 and 6-7 variable].....*C. diversus*.....(17)
16. abd 1 and 4 entirely yellow-white.....(17)
17. 1A extending far beyond fCu; yellow-white bands of abd 1 and 4 extending over anterior third or fourth of abd 2 and 5; incisures 2-3, 5-6, 6-7 and 7-8 variably yellowish; pronotum in lateral view wide dorsally and ventrally, intermediate area constricted, dorsal lobes flaring (fig. 4); scutellum with fine, inconspicuous hairs; LR about 0.67; AR about 1.8; ww with red-purple-blue reflections; lx_2/lx_1 0.50.....*C. trifascia*.....(18)
17. 1A ending about opposite fCu; abd 7 and 8 black; pronotum in lateral view not constricted medially, the dorsal lobes not appreciably flaring; scutellum with fine hairs largely in a transverse row; LR about 0.5-0.6; AR about 1.1-1.7; ww with largely bronze reflections; lx_2/lx_1 0.58 or more.....(18)
18. lt broadly darkened apically, narrowly darkened basally; scutum largely blackish; abd 5 black; lx_2/lx_1 0.61; basistyle tapering to narrow apex; pronotum in lateral view rather uniform in width from dorsum to venter (fig. 5).....*C. bicinctus*.....(19)
18. lt narrowly darkened apically, nearly all white; scutum dull yellow with dark brown vittae; abd 5 narrowly yellow-white anteriorly; lx_2/lx_1 0.67; basistyle only slightly wider basally than apically; pronotum in lateral view narrow above, gradually widening to base (fig. 6).....*C. vierriensis*.....(20)

KEY TO FEMALES

1. Cerci elongate, expanded at base and apex and tipped with 6-8 strong bristles; [legs rather uniformly yellowish brown; 3t spur long, straight].....*C. absurdus*.....(1)
1. Cerci short, not apically expanded and with numerous short bristles.....(2)
2. Legs uniformly clear yellow; [ww distinctly milky, veins glassy clear; LR 0.55; R_{2+3} strong, ending halfway between R_1 and R_{4+5} ; pronotum posteriorly depressed above and set off from scutum].....*C. flavipes*.....(2)
2. Legs entirely or partially darkened.....(3)
3. lt not distinctly ringed with white.....(4)
3. lt distinctly ringed with white.....(9)
4. $2x_1$ and $3x_1$ distinctly white-banded; abd 1, 5 and 6 yellow-white.....*C. junus*.....(5)
4. $2x_1$ and $3x_1$ not white-banded; abd 5 and 6 dark.....(5)
5. R_{2+3} weak or evanescent, almost straight, reaching C near R_{4+5} ; [ww with brownish veins, not iridescent, membrane only vaguely whitish; in dark specimens, abd dark above; in paler specimens, abd 1 and 7 and sometimes incisures yellow-white; sternites 1 to 6 or 7 whitish].....*C. elegans*.....(6)
5. R_{2+3} strong, distinctly curved and reaching C about halfway between tips of R_1 and R_{4+5}(6)
6. abd 1 greenish, rest of abd yellow-brown to black, greenish below; legs sordidly yellow, sometimes darker at joints.....*C. fugax*.....(7)
6. abd 1 black, brown or yellowish brown, similar to immediately succeeding segments; legs largely brown or black, tt sometimes slightly paler or coxae and bases of ff yellowish.....(7)
7. LR 0.66; C strongly produced beyond tip of R_{4+5} ; abd yellowish brown; long posteroventral margin of cerci slightly emarginate.....*C. politus*.....(8)
7. LR 0.55-0.58; C only slightly produced beyond tip of R_{4+5} ; abd dark brown or black; long posteroventral margin of cerci very slightly arched.....(8)
8. Scutellar hairs few, largely confined to a single transverse row; humeri pale; halteres yellowish; scutal ground color typically more or less greenish; coxae, trochanters and bases of ff yellow; cerci apically acute.....*C. infuscatus*.....(9)
8. Scutellar hairs numerous, scattered, not confined to a single row; humeri dark; halteres blackish; scutal ground color typically brownish; legs entirely dark; cerci apically broadly rounded.....*C. nostocicola*.....(10)
9. Preapical antennal bristle absent; lt with basal black band longer than apical black band and/or scutellar bristles stiff, straight, spinelike, forming a transverse row.....(10)
9. Preapical antennal bristle present; lt with apical black band longer than basal black band; scutellar bristles fine, hairlike, leaning inward in a single row.....(13)
10. At least one tergite in addition to abd 1 all or nearly all yellow-white; abd 1, 4 and 7 typically yellow-white.....(11)

10. Tergites behind abd 1 in no case all yellow-white or yellow-white with a dark saddle(12)
11. Scutum yellow with sharply defined black vittae; prescutellar area yellow; 2f and 3f largely yellow-white with sharply defined apical black band *C. trifasciatus*
11. Scutum with dark ground color; prescutellar area more or less darkened; 2f and 3f light basally and dark apically without sharp line of separation *C. tricinatus*
12. Incisures of abd 4 and 5 usually more widely yellow-white than those of other segments; L 2.0 mm *C. sylvestris*
12. Bases of abd 3 and 4 more broadly yellow-white than those of other segments; L 4.0 mm *C. flavibasis*
13. abd 5 largely or entirely yellow-white(14)
13. abd 5 largely or entirely brown or black(15)
14. abd 4 and 5 largely yellow-white; scutum yellow with 3 brown vittae; lt white with narrow apical and very narrow basal black band, the bands not sharply defined; seminal receptacles ovate, about 1.8 times as long as wide, evenly rounded at both ends *C. triannulatus*
14. abd 5 and 6 yellow-white; scutum usually brown with yellow humeri; lt white with narrow basal black band and broader apical band about $\frac{1}{3}$ length of lt, the black bands rather sharply defined; seminal receptacles about 1.9 times as long as wide, evenly rounded posteriorly, slightly to distinctly narrower anteriorly *C. diversus*
15. abd 1 and 2 entirely yellow-white or largely olive green; more posterior tergites darker in coloration(16)
15. abd 2 brown-black; abd 4 yellow-white(18)
16. abd 1 and 2 olive green, usually not sharply contrasting with rest of abd; abd 2 sometimes with brownish saddle; lt about $\frac{3}{4}$ white, the apical black band less than $\frac{1}{3}$ length of lt, with merging coloration *C. olivetus*
16. abd 1 and 2 yellow-white, usually rather sharply contrasting with rest of abd; lt only about half or slightly more white, the apical black band almost reaching middle of lt, with colors rather sharply defined(17)
17. lx entirely dark brown *C. varipes*
17. lx with at least lx₂ whitish *C. slosonae*
18. 1A extending beyond fCu as a strong vein; pronotal lobes conspicuous, flaring; pronotum in lateral view wide above and below with constriction in intermediate area (fig. 4); abd incisures often yellowish; lx₂/lx₁ 0.48; w membrane with red-purple-blue-green iridescence; [scutum yellow with brown vittae; LR 0.68; lt narrowly black basally, broadly black apically] *C. trifascia*
18. 1A weak beyond fCu; pronotal lobes nearly meeting medially, not conspicuous; pronotum in lateral view not medially constricted; abd incisures usually dark; lx₂/lx₁ 0.60; w membrane reflections predominantly bronze(19)
19. lt broadly black apically, narrowly black basally, not much more than half whitish; scutum almost

entirely black; LR 0.53; scutellum and postnotum usually concolorous; veins in area of rm brownish, darker than posterior veins; pronotum in lateral view almost uniformly wide from dorsum to venter (fig. 5) *C. bicinctus*

19. lt narrowly black apically, hardly darkened basally, about $\frac{3}{4}$ or more whitish; scutum yellowish brown with darker vittae; LR 0.48; scutellum usually yellowish; postnotum brownish; veins in area of rm not darker than posterior veins; pronotum in lateral view dorsally narrow, gradually widening to base (fig. 6) *C. vierriensis*

DISCUSSION

The area covered in this study is comprised of the 22 states located north and east of the southwestern corner of Missouri. One species has been found only in Ontario, Canada, at a latitude that suggests it should occur in the United States. Of the 21 species listed, 17 have been taken in Ohio. Order of treatment is on the basis of priority.

CRICOTOPUS SYLVESTRIS (FABRICIUS) 1794

Although originally described from Europe, the species is widely distributed in the United States from coast to coast, having been reported from New Jersey (Johnson 1900), Illinois (Johannsen 1905), Kansas (Tucker 1907), Connecticut (Britton 1920), New York (Johannsen 1928) and California (Darby 1962). It is not generally abundant. In his early work, Johannsen (1905) had no records for New York; Malloch (1915) had only a single specimen from Illinois; Roback (1957) apparently had no specimens from the Pennsylvania area; I have only 2 specimens from Ohio, both taken in July in the island area of western Lake Erie. However, Darby (1962) found the species to be abundant in California rice fields and Menzie (1980) found *C. sylvestris* to be the dominant species living in *Myriophyllum spicatum* in the Hudson River Estuary.

Species of the *C. sylvestris* group, sometimes generically placed in *Isocladus* or *Eucricotopus*, have been extremely difficult to separate. Edwards (1929) noted a high degree of variability. Hirvenoja (1973) pictured 3 color variants of the male of *C. sylvestris*: strongly pigmented, normal

and weakly pigmented. When tergite 4 of the abdomen is light, resemblance to *C. trifasciatus* is strong. Malloch (1915) separated his *C. flavibasis* from *C. sylvestris* on the basis of the bearded fore tarsus but Edwards (1929) mentioned a slight fore tarsal beard on most specimens of *C. sylvestris* which he examined. Hirvenoja (1973) listed 20 possible varieties and synonyms for this species. LeSage and Harrison (1980) noted that color pattern of Ontario specimens is extremely variable. The larvae and pupae of *C. sylvestris* have never been satisfactorily separated from those of *C. trifasciatus* and *C. tricinatus*. Hirvenoja (1973) presented keys which presume to identify these stages, but they seem to be unreliable when applied to my reared material. Differences in the pupae involve size, form and details of shagreen and respiratory organs. According to Hirvenoja (1973) specimens collected in early spring differ from those collected in summer.

The species has often been reported as doing severe damage to water-lily leaves. Of the Orthocladinae in California rice fields, *C. sylvestris* is second in abundance to *C. bicinctus*, larvae occurring in *Spirogyra* and other plants and living in tubes on the plants but also on the mud surface, their food including diatoms, green algae and occasionally also germinating seeds and leaves of rice plants (Darby 1962). Clement et al (1977) considered *C. sylvestris* to be the most important chironomid doing damage to rice plants in some areas of California. Hirvenoja (1973) associated larvae with waters having an abundance of vegetation and plant residues, where they may withstand low oxygen levels, desiccation and sewage contamination. In winter larvae occur on plants but more abundantly in sediments (Menzie 1980).

CRICOTOPUS TRIFASCIATUS (MEIGEN IN PANZER) 1813
(=*CRICOTOPUS REMUS* SUBLETTE 1964, N. SYN.)

There is understandably some disagreement with respect to the occurrence of *C. trifasciatus* and *C. tricinatus* in America. If Palearctic and Nearctic representatives are specifically distinct, our designations should be *C. remus* and *C. lebetis* respec-

tively. The difficulty is to some extent philosophical and revolves about our concept of species. It has long been known that species exhibit different traits in different parts of their range. Geographically separated populations are not likely to be precisely the same because selective factors and mutations are quite certain to be different. We should expect populations to adapt to micro-habitats and to exhibit corresponding featural differences. Widespread species are almost inevitably highly polytypic and tend to accumulate correspondingly many names. Related taxonomic problems can often be resolved only when long series of specimens are available and when complete life histories are known. In the present instance evidence currently seems to favor the use of *C. trifasciatus* for our species. All stages are closely similar to those of European material. As in Europe, we have a larger form and a smaller, more common form. Furthermore there is essentially the same relationship to *C. tricinatus* and *C. sylvestris* with respect to adult features, and the immatures apparently are identical.

Apparently *C. trifasciatus* is a widespread and highly variable Holarctic species. Adults occur throughout the summer months. In Illinois they are present from April to October (Malloch 1915). Judd (1953) recorded 2 peaks of emergence in Ontario, Canada, in July and October. Eggs are deposited in parallel gelatinous ribbons on floating vegetation and debris near pond or stream margins (Johannsen 1937); sometimes large floating gelatinous masses occur (Malloch 1915). The larvae are yellow or greenish yellow to reddish (Malloch 1915, Johannsen 1937). They feed on a variety of vegetation including leaves of *Potamogeton*, *Polygonum*, *Nuphar* and *Nymphaea* (Hirvenoja 1973, Johannsen 1937), mining in the leaves which they tend to skeletonize (Berg 1950). In a small limestone stream with heavy-metal pollution in Ohio, larvae occurred in small numbers but were absent in the most heavily polluted part of the stream which supported large numbers of *C. bicinctus* and

C. infuscatus (Winner et al 1980). Malloch (1915) found larvae in a clear-water reservoir for city water supply. Larvae typically live in silken tubes within the feeding channels which they make into the mesophyll (Wirth 1957). Larvae normally overwinter (Danks 1971). Pupation occurs in the channels, the pupal stage lasting about 1.5–3 days; pupae swim free into open water where adults emerge (Berg 1950).

Hirvenoja (1973) recognized 2 forms of *C. trifasciatus*, a larger ("grössere") and a smaller ("kleinere") form. Actually there seems to be almost infinite variation in the species. This variation applies to size, color, chaetotaxy and dimension of parts. In the case of a series of reared specimens from Squaw Harbor at Put-in-Bay, Ohio, all individuals except one have a single row of strong bristles on the scutellum, as is usual. One specimen, however, has the scutellar bristles scattered and irregularly placed. This is obviously a variant although the trait is normally considered to be of specific significance. The fourth abdominal segment may be pure yellow-white or all dark, with all variations between from a small spot to a large saddle. A light form has the anterior 4th or 3rd of the 2nd segment yellow-white and incisure 5–6 broadly yellow-white; the 7th segment is variously marked with black and white. A dark form has abdominal segment 3 all black and incisures 2–3 and 5–6 entirely black.

In 1943, many larvae of *C. trifasciatus* were collected in Squaw Harbor (Put-in-Bay, Ohio, July 16) from the upper and lower sides of the older leaves of water lotus (*Nelumbo lutea*). About 75% of larvae examined were heavily parasitized by roundworms. The worms were active and occupied most of the space in the larvae, often excluded only from the head and part of the thorax. Emergence of the parasites did not result in the immediate death of the host. Some larvae were alive 3 days after emergence. Although *C. trifasciatus* was the most abundant species on the water

lotus leaves, the following were also present, listed in order of abundance: *Endochironomus nigricans*, *Polypedilum convictum* and *Parachironomus tenuicaudatus*. In Ohio adults have been taken in every month from May to August. The following counties are represented: Franklin, Butler, Ottawa, Ashtabula, Columbiana, Tuscarawas, Erie, Lake, Mahoning, Carroll, Jefferson, Auglaize, Harrison, Guernsey and Meigs. I also have specimens from Ithaca, NY.

CRICOTOPUS BICINCTUS (MEIGEN) 1818

Currently this species is widespread and abundant in both Europe and America. It is probably the most abundant species of *Cricotopus* in the Ohio region. Evidently this was not always so. Johannsen (1905) had only several specimens; Malloch (1915) apparently also had very limited material. Simpson and Bode (1980) suggested that *C. bicinctus* is relatively most abundant where stresses eliminate other species. In Michigan larvae were shown to be particularly resistant to electroplating wastes with chromium, cyanide and copper and also to low oxygen levels (Surber 1959). In the study of a small stream receiving effluent containing copper, chromium and zinc from a metal-plating industry, *C. bicinctus* was the dominant chironomid in the area of pollution whereas in the recovery area and elsewhere in the stream the dominant species was *C. infuscatus* (Winner et al 1980). Rosenberg and Wiens (1976) found that the species responded positively to crude oil and petroleum products contamination. Rosenberg et al (1977b), on the basis of laboratory experiments, even suggested a beneficial effect of crude oil on *C. bicinctus* for larvae were always more abundant on oiled artificial surfaces than on unoled surfaces. Larvae occur in ponds (Judd 1960, 1964), rivers (Surber 1959) and creeks (Winner et al 1980). The species is the most abundant member of the Orthocladiinae in California rice fields (Darby 1962), preferring locations where water is moving most rapidly. In creeks larvae tend to be most abundant where the stream

forms cascades (Paine and Gauvin 1956). The species often occurs in the same general environment with *C. trifasciatus* and *C. sylvestris* if both algae and higher plants are present (Buckley and Sublette 1964, Winner et al 1980, Darby 1962, Judd 1964).

There are probably at least 3 generations per year. In Northwest Territories overwintering occurs mainly in the second larval instar (Rosenberg et al 1977a). Males commonly swarm several feet above the ground. Oviposition, which occurs late in the evening or early in the morning, is accomplished as the female skims the water surface and dips her abdomen into the water in flight (Darby 1962). Apparently larvae are associated with a wide variety of aquatic plants but Darby (1962) noted them particularly abundant in masses of *Spirogyra*; this alga, together with desmids and diatoms, also serves as food. Early larvae migrate readily but late larvae tend to remain in their tubes (Darby 1962), which are thin and transparent. Adults show a wide degree of variation with respect to pigmentation; October and November specimens tend to be deep black; those of midsummer are often light brown. In some individuals the white abdominal bands are obscured. Structural and dimensional variations are also common. Females may have only 4 joints in the antennal flagellum. In Ohio, adults occur from April to November. I have records from the following counties: Butler, Clinton, Ottawa, Erie, Lucas, Jefferson, Muskingum, Morgan, Franklin, Auglaize, Fairfield, Licking, Shelby, Ashtabula, Tuscarawas, Harrison, Belmont, Guernsey, Lawrence and Scioto. I also have specimens from Michigan, New York and Delaware.

CRICOTOPUS TRICINCTUS (MEIGEN) 1818
(=*CRICOTOPUS LEBETIS* SUBLETTE 1964, N. SYN.)

Both Schiner (1864) and Johannsen (1905) considered this to be a variety of *C. trifasciatus*. Later Edwards (1929) and Johannsen (1952) accorded *C. tricinctus* specific rank. Recent American workers, following Sublette (1964), tend to consider

Nearctic material specifically distinct under the name of *C. lebetis*. The nomenclatorial problem relative to widespread species has been discussed above. For the present I am inclined to consider *C. lebetis* the Nearctic form of *C. tricinctus*. Although *C. tricinctus* is here treated as specifically distinct from *C. trifasciatus*, it is conceivable that the former is in reality only a dark form of the latter. It is interesting to note that Hirvenoja's larger form of *C. trifasciatus* has leg coloration which is usually associated with *C. tricinctus*. Early April specimens of *C. tricinctus* may be almost altogether black, including the entire scutum, together with all of the 7th and much of the 4th abdominal segments.

In Europe larvae of *C. tricinctus* inhabit ponds, lakes and slow-flowing waters where they feed on leaves of *Potamogeton* and probably other plants (Hirvenoja 1973). In the littoral zone of Lake Texoma, Sublette (1957) found larvae most frequently on *Potamogeton*. Paine and Gauvin (1956) reported the species from Lytle Creek in Ohio. Mason and Sublette (1971) collected *C. lebetis* from the Ohio River near Cincinnati. I have specimens from counties Butler, Ottawa and Clermont in Ohio.

CRICOTOPUS TRIANNULATUS (MACQUART) 1826

This was long considered to be essentially a northern European species. Recently, however, LeSage and Harrison (1980) reported it from Canada, at the same time declaring *C. exilis* a synonym. Originally *C. exilis* was described by Johannsen (1905) from New York where larvae inhabit the rocky bottom of a shallow swift creek (Johannsen 1937) in the vicinity of Ithaca. The distribution is now known to extend from Delaware and New Jersey westward to Wisconsin (Bray and Triplehorn 1953, Johannsen 1952, Sublette and Sublette 1965). Malloch (1915) did not find it in Illinois. In Ohio *C. triannulatus* is extremely abundant at times in the island area of western Lake Erie in the shallow water adjacent to land where the bottom is composed of rocks and boulders and where wave action may be severe (Shelford and

Boesel 1942). In Ohio it occurs also in limited numbers in the shallow water of small hard-bottom creeks (Paine and Gaufin 1956, Winner et al 1980). The yellowish green larvae construct silken tubes. Adults occur in Ohio from April to November. I have records from the following counties: Butler, Ottawa, Erie, Lucas, Franklin, Ashland, Lake, Mahoning, Harrison, Muskingum, Brown, Jefferson and Belmont. I also have specimens from Ithaca, NY.

CRICOTOPUS POLITUS (COQUILLET) 1902

This species has been reported from the east coast to Kansas and Colorado and from Ontario, Canada, to Florida (Tucker 1907, LeSage and Harrison 1980, Sublette and Sublette 1965). Not much is known about its ecology although it has been taken from lakes (Mason and Sublette 1971), reservoirs (Iovino and Miner 1970) and streams (Paine and Gaufin 1956). Mason and Sublette (1971) collected it from the Ohio River near Cincinnati. Paine and Gaufin (1956) found it to be restricted to clean water in Lytle Creek, Ohio. The species has been abundant in the island area of western Lake Erie where larvae are found on rocks of the Hydropsyche-Goniobasis community (Shelford and Boesel 1942). I have not found it to be abundant elsewhere. Specimens have been collected on Pelee Island, Canada. In Ohio adults occur in every month from April to August. The following counties are represented: Ottawa, Erie, Franklin, Highland, Ashland, Butler and Ashtabula.

CRICOTOPUS VARIPES (COQUILLET) 1902

Unfortunately records for *C. varipes* are more or less untrustworthy due to the difficulty of distinguishing between this species and *C. slossonae*. Their larvae seem to be identical; pupae are separated with difficulty. Johannsen described the larva and pupa of *C. varipes* in 1905. Apparently he later considered the descriptions invalid for he omitted reference to them in his extensive work in 1937. As indicated in the discussion of *C. slossonae*, adult specimens occur which must be placed rather arbi-

trarily. LeSage and Harrison (1980) found a puzzling adult form intermediate between *C. varipes* and *C. slossonae* which they thought might actually represent a third species. Color variations are common. Normally the first and second abdominal segments are all white, but I have specimens with a strong brown saddle on the second segment. The light margins of abdominal segments 3 and 4 are variably present and segments behind 4 may have light margins. Essentially all gradations of fore tarsal pigmentation occur from partly white to all black. Under the circumstances I have unified collection data for *C. varipes* and *C. slossonae*.

Rosenberg and Wiens (1976) indicated that *C. varipes* shows a strong positive response to crude oil contamination but not to the degree shown by *C. bicinctus*. Winner et al (1980) found that, in a small stream subject to heavy-metal pollution, *C. varipes* and *C. slossonae* were absent in the immediate area of pollution but were present in all stations of the recovery area; both *C. bicinctus* and *C. infuscatus* were abundant in the pollution area.

The species or combination of species is widely distributed from Northwest Territories to Florida and from Oregon and Washington to the east coast (Sublette and Sublette 1965, LeSage and Harrison 1980). Specimens have been taken in the following Ohio counties: Butler, Ottawa, Harrison, Belmont, Muskingum, Jackson, Franklin, Brown, Ashland, Tuscarawas, Licking and Fairfield. Adults occur from April to November. I also have specimens from New York, Michigan and Canada (Pelee Island).

CRICOTOPUS ABSURDUS (JOHANNSEN) 1905

Johannsen described the species from a single female taken at Ithaca, NY. The only other record is that of Paine and Gaufin (1956) who collected 11 specimens from Lytle Creek (Clinton County, Ohio) where Ordovician limestone forms the bottom. Associated species were *Polypedilum illinoense* and *Cricotopus politus*. The larvae were found only in the clean water sections

of the stream. I have only 13 specimens from Ohio, all from Oxford except for a single specimen from Columbus. All are females. The male is unknown. Ohio collection dates range from May 24 to July 16. Four species are known which are similar to *C. absurdus* with respect to the highly unusual female cerci; all are Neotropical (Canal Zone, Puerto Rico, Peru). In one species, both sexes have a brown abdomen (Sublette 1967); in the other 3, both sexes have the abdomen banded with yellow; one is similar to *C. bicinctus*. Roback (1962) noted males of species related to *C. absurdus* are typical *Cricotopus* except possibly for the metatibial spur which is unusually long, about 2.4 or more times the width of the apex of the metatibia; generally the length in *Cricotopus* is only about equal to the width of the metatibial apex.

CRICOTOPUS FUGAX (JOHANNSEN) 1905

Although Johannsen described the larva, pupa and both sexes of *C. fugax*, the species is poorly known. Johannsen (1937) found the bluish green larvae in tubes of debris on rock surfaces in a shallow, swift creek. He indicated the larval labial plate is similar to that of *C. trifasciatus*. According to Sublette (1966) the male genitalia closely resemble those of *C. politus* except for coloration. I have only 4 specimens tentatively assigned to *C. fugax*, from New York and Michigan, but lack records for Ohio. Apparently the species has not been positively identified and reported since it was discovered by Johannsen.

CRICOTOPUS FLAVIBASIS MALLOCH 1915

Both male and female were originally described from Illinois. Malloch (1915) apparently had 3 specimens (Sublette 1970). The species has since been recorded from South Dakota (Hudson 1971); British Columbia and Alberta, Canada, (Cannings 1975). However it is not well known. Sublette (1970) noticed the wing venation is similar to that of *C. trifasciatus* and male genitalia resemble those of *C. remus*, which I believe to be a form of *C. trifasciatus*. Malloch (1915) separated *C. flavibasis* from *C. sylvestris* because of the long hairs on the

male fore tarsus. However *C. sylvestris* may have a slight beard (Edwards 1929). I have not seen specimens with a beard sufficiently long to be separated from *C. sylvestris*. The immatures have not been described. Ohio records are lacking. This may prove to be a form of *C. sylvestris* or *C. trifasciatus*.

CRICOTOPUS SLOSSONAE MALLOCH 1915

Early Nearctic records of *C. tremulus* probably represent misdeterminations of *C. slossonae*. Traditionally *C. slossonae* has been regarded as closely related to *C. varipes*, differing principally in the color of the fore legs and abdomen and in the genitalia. However, individuals occur which tend to close the gap between the species. Separation of the immatures has always been a problem. LeSage and Harrison (1980), working on a single Canadian stream, observed that *C. varipes* precedes *C. slossonae* in spring emergence but succeeds it in fall. This suggests that *C. varipes* may be a dark form and *C. slossonae* a light form of a single species. My specimens represent many localities and do not reveal this relationship. Although strongly tempted to synonymize *C. slossonae* with *C. varipes*, I am tentatively keying them as separate on the basis that they may be incipient species. But due to the questionable nature of some determinations I have combined collecting data for the 2 species under *C. varipes*. I believe they will ultimately prove to constitute one highly variable species.

CRICOTOPUS INFUSCATUS (MALLOCH) 1915

(=*CRICOTOPUS ARATUS* ROBACK 1957, N. SYN.;
=*CRICOTOPUS CERIS* ROBACK 1957, N. SYN.)

Malloch (1915) originally described *C. infuscatus* from Illinois. Hudson (1971) later reported it from South Dakota. In Ohio it proved to be abundant in a small limestone stream subject to heavy-metal pollution; it was second only to *C. bicinctus* in the area of heaviest pollution and dominant in the recovery area (Winner et al 1980). That study provided material for an extensive study of variation in the species. Size and intensity of color are extremely

variable. In paler specimens mid and hind femora tend to be gradually darkened from tip to base but in darker specimens they may be completely blackish except for the base. The scutellum varies from infusate yellow to nearly black. Some females are smaller than *C. aratus* which has been set off largely on the basis of size. Female antennal segments vary in length; sometimes adjacent flagellomeres are fused. Appearance of genitalia varies with viewing angle. Male genitalia of *C. infuscatus* as shown by Malloch (1915) and *C. ceris* as shown by Roback (1957) represent slightly different views. In the former the inner edges of the basistyle are nearly coincident whereas in the latter they are widely separated. The triangular edge of the outer half of the basistyle tends to disappear in the former view because it is turned inward. The basal appendages vary depending on degree of contraction or extension. Specimens which I originally identified as *C. aratus* and *C. ceris* are obviously only forms of *C. infuscatus*. Larvae of a closely related California species, *Cricotopus fuscatus*, occur in colonies of the alga *Nostoc* (Wirth 1957). In Ohio *C. infuscatus* has been collected in the following counties: Butler, Lucas, Guernsey, Franklin and Belmont. I also have specimens from Michigan and New York. Adults occur in every month from March to November.

CRICOTOPUS TRIFASCIA EDWARDS 1929

Although known to occur widely in the Palearctic region from England and France southward and eastward to Palestine and Sakhalin Island off the coast of Asia, this species seems to be nowhere abundant. In America it has been known as *Cricotopus ithacanensis*, described by Sublette (1967) from a single misdetermined male in the Cornell University collection. Roback (1957) found the larva in Pennsylvania and referred to it as *Cricotopus* sp. 1. Simpson and Bode (1980) recognized larvae collected from streams in New York as belonging to the *C. trifascia* group. They described larval distribution as "patchy,"

larvae occurring in only half of the streams studied and in only 10% of the samples. They believed the larvae to be saproxenous. In a small limestone stream near Oxford, Ohio, larvae were present in small numbers. In 1980 LeSage and Harrison synonymized *C. ithacanensis* with *C. trifascia* and recorded the species from Ontario. I have 49 adults from Ohio, with collection dates from May to August; counties represented are Butler, Ottawa, Ashland, Guernsey, Muskingum and Franklin. I also have adults from Michigan (Douglas Lake area) and New York (Ithaca).

CRICOTOPUS VIERRIENSIS GOETGHEBUER 1935

The species has only recently been reported from the Nearctic region by Oliver (1977), who recorded it from Manitoba, Canada, and cited a single-specimen record from Pennsylvania. Johannsen probably regarded this as a variant or form of *C. bicinctus* for I have taken specimens in the area of Ithaca, NY. The species was described by Goetghebuer in 1935. In 1950 Goetghebuer and Lenz listed *C. vierriensis* as a junior synonym of *Cricotopus decorus*, described by Goetghebuer in 1927. Hirvenoja (1973) regarded *C. decorus* as a junior synonym of *Cricotopus similis*, described by Goetghebuer in 1921; however, he accorded specific rank to *C. vierriensis*. The early stages of *C. vierriensis* have been described as extremely similar to but separable from *C. bicinctus*. Specimens which I have determined as *C. vierriensis* check very well with early descriptions of *C. similis*, suggesting the species may be identical. However, male genitalia as shown by Hirvenoja (1973) are very different. In Europe *C. vierriensis* larvae inhabit standing waters and can survive in waters with high salt concentrations. Ohio records include the following counties: Butler, Franklin, Ashtabula, Mahoning, Harrison, Belmont, Muskingum, Ottawa, Jefferson and Fairfield. Other states represented are New York and Michigan. Collection dates for adults include every month from April to August.

CRICOTOPUS FLAVIPES JOHANNSEN 1942

The male, female, larva and pupa of this species were described by Johannsen from specimens collected and reared by Berg in Michigan. Berg (1950) provided details of the life history which are here briefly summarized. Adults occur from June to August. Late-instar larvae make linear mines in the submerged leaves of *Potamogeton*; mines tend to parallel the leaf margins. Larvae remove all tissue between the epidermal layers, leaving curved marks made by the mandibles. Apparently only third- and fourth-instar larvae mine the leaves, early larvae living in the plant stems, where they overwinter. The larvae probably feed on algae which they draw into their mines. I have 5 specimens of *C. flavipes*, 2 from Ohio (Middle Bass Island) and 3 from New York (Ithaca), adding 2 states to the single-state records of Berg.

CRICOTOPUS ELEGANS JOHANNSEN 1943

Larvae, pupae and adults of this species were originally collected by Berg from the Huron River in Michigan. Berg (1950) published details of the life history. Larvae of the first, second and third instars mine in the coriaceous floating leaves of *Potamogeton*, riddling them with an irregular network of crisscrossing mines. Fourth-instar larvae were not found in the leaves in the field but under laboratory conditions fed on various parts of the plants. Adults occurred in Michigan from May to October (Berg 1950). Apparently the only other published record for *C. elegans* is that of Roback (1957) who collected one specimen from a Pennsylvania creek having a variety of plants including *Potamogeton*. I have collected 81 adults from April to August in Ohio, particularly from the island area of western Lake Erie; islands represented are South Bass, North Bass, Middle Bass, Green, East Sister, Ballast and Catawba. A single specimen was taken on Pelee Island (Canada). Each of 2 counties, Butler and Erie, yielded 2 specimens.

CRICOTOPUS JUNUS ROBACK 1957

This species was described from Pennsylvania with respect to the female,

larva and pupa. The male is unknown. Females should easily be recognized on the basis of the entirely brown fore leg, the banding of the abdomen and the distinctly white-banded first tarsal segment of the mid and hind leg (Roback 1957). Roback collected larvae from creeks with bottom of rock, gravel and some mud. I have not seen the species.

CRICOTOPUS NOSTOCICOLA WIRTH 1957

Larvae of *C. nostocicola* occur in colonies of the blue-green alga *Nostoc* (Wirth 1957) and were originally described by Johannsen (1937) under the name of *Spaniotoma* sp. G. They attach the algal colonies to rocks and other objects in both lentic and lotic situations, feeding on the algal matrix; in California adult emergence peaks in March and April, with light emergence in July and August (Brock 1960). The species has been recorded from California, Oregon, Montana, Connecticut, West Virginia and Tennessee (Johannsen 1937, Wirth 1957, Brock 1960, Beck 1980). In California, *Cricotopus fuscatus* also occurs in the algae and is separable from *C. nostocicola* only in the adult stage (Brock 1960). I have only 9 specimens of *C. nostocicola* from Ohio, all collected at Columbus in April.

CRICOTOPUS DIVERSUS NEW SPECIES

Originally I anticipated that females of this species would prove to be *C. junus* because of the abdominal coloration. However leg coloration is conspicuously unlike that of *C. junus*. In all of my specimens the fore tibia is white, broadly black at the apex and narrowly black at the base. Furthermore both mid and hind tibiae are white, darkened at the ends; mid and hind tarsi are infusate, gradually darkened apically. In *C. junus* the fore leg is entirely brown and the first tarsal segment of the mid and hind leg are distinctly white-banded (Roback 1957). In some respects *C. diversus* is superficially similar to the European *C. festivellus* as described by Hirvenoja (1973) and Goetghebuer and Lenz (1950) and reported from Canada by LeSage and Harrison (1980). However the male differs sharply in abdominal color-

ation. In *C. diversus* the yellow-white band involving the fourth and fifth abdominal segments is broad, at least two-thirds of the former being light. In *C. festivellus* the band is narrow, less than half of the former being yellow-white. Also in *C. diversus* the second abdominal light band is very narrow whereas in *C. festivellus* it is broad.

Males were swarming on Gibraltar Island in Lake Erie on the evening of July 31, 1933. The species is known to range from Michigan and Ohio eastward to New York and Delaware. Early stages are unknown. On a number of occasions adults have been taken from windows inside buildings on the Miami University campus.

MALE. L 2.5 mm. WL 1.6 mm. Head yellow to light brown below antennae; vertex brown. Antennal flagellum brown, lighter basally; scape dark brown. AR 1.4. Palps brownish; palpal ratio 6:6:15:18:33. Pronotum narrowing gradually to dorsum in lateral view, not flaring; yellow to brown, bare. Scutum brown to blackish, shining; humeri yellowish (light specimens yellow with brown vittae). Scutellum with fine inconspicuous bristles, leaning medially; dark brown, like scutum (light specimens with scutellum pale brown, narrowly yellow anteriorly). LR ($1x_1/1t$) 0.62. ff dark brown apically, yellow basally, without sharp line of division; 2t and 3t yellowish white, narrowly darkened at ends, more broadly apically; 1t white, broadly darkened apically, narrowly basally, about half or a little more white; 2x and 3x light brown or infusate, lighter than 1x, darker apically. w brownish with largely bronze reflections, more or less iridescent along costal margin and rarely apically. R with about 5 setae; other veins normally bare. Veins brownish; R_{2+3} quite distinct, reaching C about midway between R_1 and R_{4+5} ; C only slightly produced; 1A short, reaching level of fCu. Halteres yellow. General appearance of abd dark with 2 broad yellowish bands; abd brown with yellow-white as follows: abd 1 (rarely somewhat darkened),

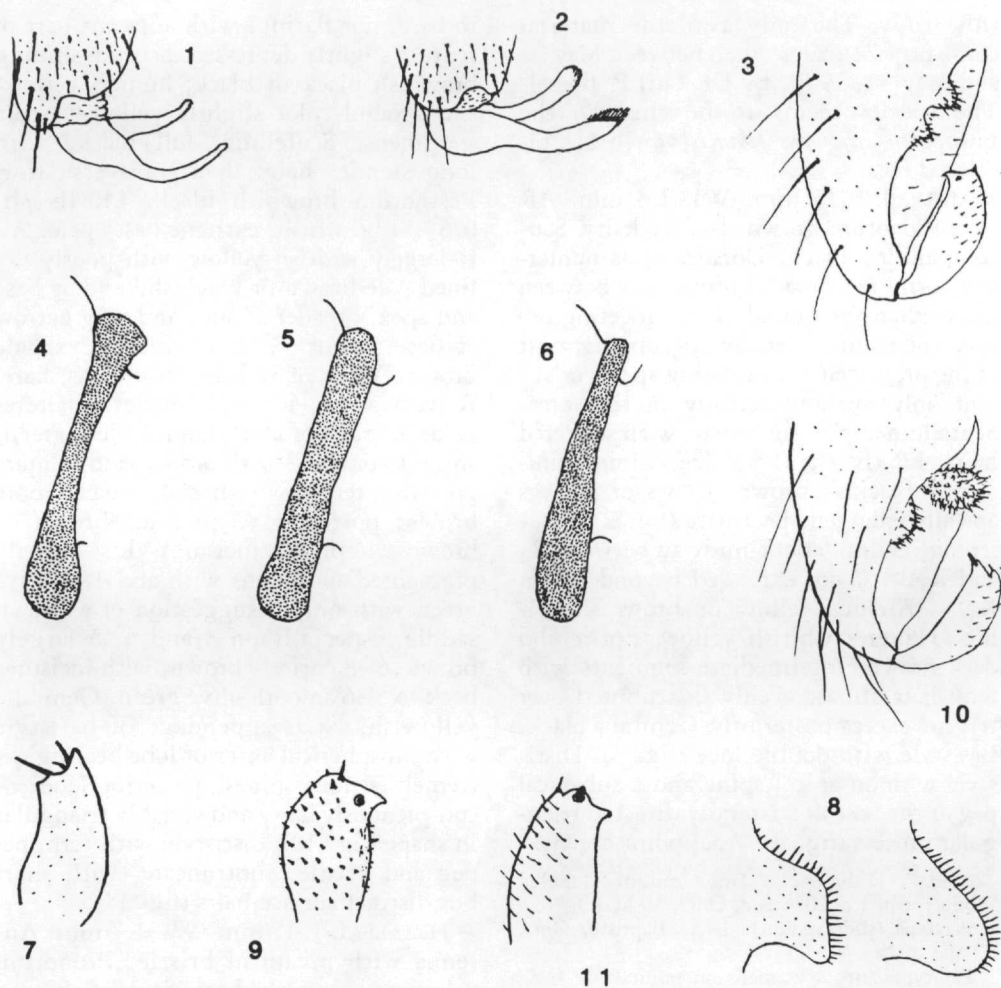
incisures 2–3 rather broadly and 3–4 rather narrowly, posterior $\frac{3}{4}$ to $\frac{7}{8}$ of abd 4 and anterior $\frac{2}{5}$ of abd 5; posterior incisures vaguely lighter. Genitalia yellow-white; dististyle with several unequal apical bristles (fig. 7); inner lobe of basistyle single, angular or apically rounded, depending on view (fig. 8). Color of abd 2 highly variable, ranging from largely black in dark specimens to largely yellowish, particularly at the ends.

FEMALE. L 1.55 mm. WL 1.45 mm. Terminal antennal flagellomere longer than preceding 3 combined. Preapical antennal bristle present. Pronotum distinctly wider ventrally in lateral view, yellowish to brownish, bare. Scutum usually brown, shining, with yellowish humeri. Scutellum with a single slightly irregular row of fine hairlike bristles leaning medially. LR 0.58. ff apically black, grading to yellowish at base; 1t broadly (about half) white, apex broadly and base narrowly blackened; 2t and 3t white, slightly darkened at ends; 1x brown; 2x and 3x infusate, darker apically. w brownish with largely bronze reflections; 1A not strong beyond level of fCu. R with about 6 setae; R_{4+5} with about 3–5 setae. abd 1, 5 and 6 yellow-white; abd 2, 3 and 4 sometimes posteriorly pale-margined together with narrow anterior margin of abd 2. Seminal receptacles about 1.9 times as long as wide, evenly rounded and wider posteriorly, narrow anteriorly. Cerci subtriangular to apically rounded.

TYPES. Holotype: 1 ♂, slide mount labeled "Holotype" (specimen a), Put-in-Bay, OH, 21 June 1946. Allotype: 1 ♀, slide mount labeled "Allotype," same data as holotype.

Paratypes (slide mounts): 9 ♂♂, 2 ♀♀. Put-in-Bay, OH, 21 June 1946, 12 July 1944, 8 July 1942, 26 July 1924, 9 July 1924, 30 June 1924; 1 ♂. Middle Bass Island, OH, 10 Aug. 1945; 1 ♀, Columbus, OH, 16 Apr. 1925.

Paratypes (dry specimens on points): 3 ♂♂, 3 ♀♀, Oxford, OH, 17 July 1976, 22 June 1973, 13 June 1972, 26 May 1972, 28 Apr. 1938, 12 Oct. 1937; 7 ♂♂, 8 ♀♀, North Bass Island, OH, 15 Aug. 1940, 26 June 1937, 19 July 1933, 15 July 1933, 10 July 1933; 2 July 1926, 9 July 1925; 33 ♂♂, 4 ♀♀, Put-in-Bay, OH, 9 Aug. 1940, 27 July 1940, 18 July 1940, 24 June 1940, 20 June 1940, 30 June 1937, 24 June 1937, 23 June 1937, 21 June



FIGURES 1-11. (1) *Cricotopus infuscatus* ♂: tarsal claw of mid leg. (2-3) *Cricotopus baptistensis* ♂: (2) tarsal claw of mid leg, (3) genitalia. (4) *Cricotopus trifascia* ♂: pronotum. (5) *Cricotopus bicinctus* ♂: pronotum. (6) *Cricotopus vierriensis* ♂: pronotum. (7-8) *Cricotopus diversus* ♂: (7) dististyle, (8) variations of inner lobe of basistyle. (9) *Cricotopus baptistensis* ♂: apex of dististyle. (10-11) *Cricotopus olivetus* ♂: (10) genitalia, (11) apex of dististyle, another view.

1937, 1 Aug. 1933, 31 July 1933, 30 July 1926, 29 July 1926, 26 July 1926, 4 July 1926, 1 July 1926, 25 June 1926, 23 June 1926, 30 July 1925, 15 July 1925, 10 July 1925, 8 July 1925, 4 July 1926, 1 July 1925, 30 June 1925, 26 June 1925; 1 ♂, Erie Co., OH, 2 July 1940, 7 ♂♂, 9 ♀♀, Middle Bass Island, OH, 2 July 1957, 27 June 1940, 6 July 1937, 4 Aug. 1933, 7 July 1933, 28 June 1926, 24 June 1926, 24 July 1925, 21 July 1925; 2 ♂♂, 2 ♀♀, Catawba Island, OH, 24 July 1933, 3 July 1926, 11 July 1925; 1 ♂, Mackinac Island, MI, 15 July 1928; 1 ♂, Franklin Co., OH, 15 May 1928; 1 ♂, 1 ♀, Trumbull Co., OH, 4 July 1927; 1 ♂, Muskingum Co., OH, 26 June 1927; 4 ♂♂, 1 ♀,

Pelee Island, Canada, 23 July 1926, 25 July 1925; 2 ♂♂, Ashland Co., OH, 22 May 1926; 2 ♂♂, Lancaster, OH, 8 May 1926; 7 ♂♂, 3 ♀♀, Lockbourne, OH, May 1926, 23 May 1925; 1 ♂, Columbus, OH, 29 May 1925; 2 ♀♀, Ithaca, NY, 18 June 1934, 27 May 1934; 2 ♀♀, Grove City, OH, 4 Apr. 1925. All types are currently in the Boesel collection.

CRICOTOPUS BAPTISTENSIS NEW SPECIES

This species is included here because it occurs in Ontario, Canada, at a latitude south of parts of Michigan and Maine and is therefore likely to be found in the area of

this study. The only available material consists of 21 males taken between May 27 and May 31, 1970, by Dr. Carl P. Boesel. The species seems to be close to the European *Cricotopus tibialis* which has bi-colored legs.

MALE. L 3.15 mm. WL 2.3 mm. AR 1.6. Pronotum brown, basally hairy. Scutum shining black. Dorsocentrals numerous, forming a broad confused row between the median and lateral vittae, meeting behind the median vitta and occupying most of the prescutellar area, being sparse or absent only medioposteriorly in that area. Scutellum appearing brushy with scattered hairs. LR (l_{x_1}/l_t) 0.67. Legs almost uniformly blackish brown. Claws of all legs apically enlarged, pectinate (fig. 2). R_{2+3} strong, ending about midway between R_1 and R_{4+5} . C not extended beyond end of R_{4+5} . Arculus yellow or brownish yellow. Halteres whitish yellow. Entire abd dark brown, intermediate segments with long hair almost evenly distributed over tergites except posteriorly. Genitalia black. Basistyle with double lobe (fig. 3). Dististyle with an apical spine and a subapical peg at the base of a laterally directed triangular process (fig. 9). Anal point absent.

TYPES. Holotype (slide mount labeled "Holotype"): 1 ♂, Baptiste, Ont., 30 May 1970.

Paratype (slide mount): 1 ♂, Baptiste, Ont., 27 May 1970.

Paratypes (dry specimens on points): 19 ♂♂, Baptiste, Ont., 31 May 1970, 30 May 1970, 27 May 1970. All types collected by C. P. Boesel and currently in the Boesel collection.

CRICOTOPUS OLIVETUS NEW SPECIES

Abdominal coloration in this species is suggestive of *C. fugax* but leg coloration and ♂ genitalia as figured by Sublette (1967) are conspicuously different. The latter are most similar to those of *Cricotopus annulator* as illustrated by LeSage and Harrison (1980); however I have no specimens agreeing with the abdominal color pattern of *C. annulator* as shown by Goetghebuer and Lenz (1950).

MALE. L 2.7 mm. WL 1.8 mm. AR 1.5. Pronotum yellow to brownish, bare; in lateral view, narrow above, gradually widened

to base, not flaring, with adjacent part of scutum slightly depressed. Scutum shining brownish black or black; humeri yellowish; ground color slightly yellow in pale specimens. Scutellum dull black, with long slender hairs in a transverse row. Postnotum brownish black. LR (l_{x_1}/l_t) 0.63. ff brownish, extreme bases pale. All tt largely whitish yellow with poorly defined pale brown or blackish band at base and apex, broader at apex and very narrow at base, about $\frac{3}{4}$ of l_t whitish. xx pale brown. Veins of w brownish; R_{4+5} bare; R with about 4 (1–7) bristles. Halteres pale. Tergites of abd 1 and 2 olive green, shining, or abd 2 with brown saddle, more posterior tergites with successively more brown; posterior tergites all brown or brown except for incisures. Less heavily pigmented specimens with abd 1–4 olive green with only a suggestion of a brown saddle, especially on 3 and 4, 5 largely brown, 6–8 entirely brown, with incisures back to 5–6 smooth olive green. Genitalia yellowish; basal appendage of basistyle with subspherical anterior lobe bearing extremely strong spines, posterior lobe inconspicuously hairy and variably triangular in shape (fig. 10); dististyle with terminal peg and bristle, subtruncate, with short but distinct surface hairs (fig. 11).

FEMALE. L 1.45 mm. WL 1.7 mm. Antenna with preapical bristle. Pronotum yellow to brownish, bare. Scutum shining black, ground color slightly lighter. Scutellum dull blackish, with row of fine bristles leaning inward. LR (l_{x_1}/l_t) 0.61. It largely white except narrowly at base and more broadly at apex. l_x entirely and uniformly brown. w hyaline. R_{2+3} distinct, ending about halfway between R_1 and R_{4+5} . C distinctly produced. abd 1 and 2 olive green; rest of abd dark brown. Seminal receptacles subspherical, lightly sclerotized, about 0.16 mm in diameter. Genitalia whitish. Cerci anteroventrally acute.

TYPES. Holotype: 1 ♂, slide mount labeled "Holotype," Put-in-Bay, OH, 30 June 1926. Allotype: 1 ♀, slide mount labeled "Allotype," Put-in-Bay, OH, 14 July 1926.

Paratypes (slide mounts): 7 ♂♂, 2 ♀♀, Put-in-Bay, OH, 21 June 1946, 23 June 1926, 20 June 1926, 15 July 1925, 2 July 1925, 2 July 1924, 30 June 1924, 20 June 1924; 4 ♂♂, Middle Bass Island, OH, 17 July 1946, 28 June 1926, 24 June 1926; 1 ♂, East Harbor, Carawba Island, OH, 11 July 1925; 1 ♀, Franklin Co., OH, 15 May 1928; 1 ♀, Ashland Co., OH, 8 July 1927; 1 ♀, North Bass Island, OH, 9 July 1925.

Paratypes (dry specimens on points): 4 ♂♂, 2 ♀♀, Middle Bass Island, OH, 22 Aug. 1940, 28 June 1924, 24 June 1926; 8 ♂♂, 4 ♀♀, Put-in-Bay, OH, 30 June 1937, 23 June 1937, 1 July 1926, 30 June 1926, 23 June 1926, 20 June 1926, 15 July 1925, 5 July 1925, 2 July 1925; 1 ♀, Carawba Island, OH, 19 July 1937; 4 ♂♂, 2 ♀♀, North Bass Island, OH, 26 June 1937, 2 July 1926, 9 July 1925; 2 ♂♂, Oxford, OH, 25 May 1937, 19 June 1929; 4 ♂♂, 2 ♀♀, Ithaca, NY, 2 July 1934, 7 June 1934, 3 June 1934, 2 June 1934, 13 May 1934; 2 ♀♀, Franklin Co., OH, 15 May 1928, 13 May 1928; 1 ♀, Ashland Co., OH, 8 July 1927; 1 ♀, Tuscarawas Co., OH, 30 June 1927; 1 ♀, Greenville, OH, 29 May 1926; 1 ♀, Columbus, OH, 29 May 1925.

All types for *C. olivetus* were collected by M. W. Boesel and are currently in the Boesel collection. In addition to the types I have specimens collected by Dr. C. H. Kennedy on Goose Island, MI, on July 10, 1928.

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EDITOR'S NOTE

The backlog of manuscripts has now been reduced to the extent that new papers can appear in *The Ohio Journal of Science* less than 12 months after acceptance.